

## SCIENCE

**Bernal, J. D.** *Science in History*. London, 1954. Watts. Pp. xxiv + 967. Price 42s.

MUCH of what passes for the history of science consists of little more than lists of outstanding events and persons in chronological order. Sometimes, a certain coherence is given by linking the events to the development of theory in some branch of science. Many have thus been led to believe that the development of science has depended essentially on the work of a series of great men, each building logically on the foundation laid by predecessors. A rational history of science must however take account of much more than geniuses and their theories, however important these may be. Scientists themselves, those who make use of science, those who pay for it or talk about it, are all part of human society, and are acted upon by a great variety of complex influences.

The most obvious of the non-scientific influences which affect scientists are economic. Bernal writes, for instance:

The mechanical knowledge and attainments of the Hellenistic period were in themselves quite sufficient to have produced the major mechanisms that gave rise to the Industrial Revolution . . . but they stopped short of this point . . . The decisive reason was the lack of motive. The market for large-scale manufactured goods did not exist. The rich could afford hand-made goods, the poor and the slaves could not afford anything they could do without.

But he makes clear that there are many other sorts of causal agency at work in the evolution of scientific practice and ideas. His book is an attempt to provide, for the whole of human history and prehistory, an account, in causal terms, of science as a social activity.

The term "science" is accordingly used to cover a great range of human activities, and its definition alone occupies some thirty pages. Moreover, Bernal is concerned, not merely with science as a system or institution with an internal coherence, but with its interactions with all features of society. He is thus concerned to trace certain major

features of human society—all those involved in the control by man of his environment, and the ideas related to the methods of control. As an example we may take a passage from the section on medieval science.

Of all the inventions introduced to the west in the Middle Ages, it was the most destructive—gunpowder—that was to have the greatest effect politically, economically, and scientifically. . . . Only wealthy republics or kings backed by merchants could command sources of metal and the technical skill to fashion it into cannon. This fact broke the independence of the land-based aristocracy as surely as their castles were battered down by cannon balls. The triumph of gunpowder was the triumph of the national State and the beginning of the end of the feudal order.

At sea . . . used in naval guns, mounted in ships directed by the new astronomy and the compass, gunpowder was to make the western Europeans supreme . . . It enabled Europeans to stamp their pattern of culture on others, originally by no means inferior, culturally or militarily. More immediately it enabled them . . . to possess the accumulation of wealth which financed the Industrial Revolution.

. . . Gunpowder and the cannon not only blew up the medieval world economically and politically; they were major forces in destroying its system of ideas. . . . In the first place they were something new . . . the Greeks did not have a word for them. In the second place the making of gunpowder, its explosion, the expulsion of the ball from the cannon, and its subsequent flight furnished problems the practical solution of which led to a search for causes of a new kind and the creation of new sciences.

This type of analysis is applied to all civilizations and to all sciences, up to the nineteen-fifties. Inevitably this involves treading on toes of specialists in a great variety of fields: almost any scientist could no doubt pick on some detail to criticize. But in a short review such criticism would be irrelevant. *Science in History* provides, for the first time in our own period, a unified interpretation, not only of the growth of the natural sciences, but of human society. Nearly one-fifth of the book is devoted to a brilliant and constructive critique of the social sciences. This, and the preceding section on the biological sciences of our day, should be read by every man or woman working in the fields of biology, medicine or agriculture.

The book is however not primarily addressed to specialists. Like Wells' *Outline of History* it is likely to have a profound influence on the "common reader", especially perhaps the young man or woman of sixth-form or undergraduate status. With them, as with their elders, it will undoubtedly stimulate both reflection and a desire to read much more. (There is a vast and excellent bibliography.) Bernal's object is however not merely the extension of passively acquired knowledge, but also the solution of the practical problems of our time. Of the ideal of pure science as contemplation, originating in the ancient world, he comments: "Now, as then, it provides a con-

venient excuse for enjoying knowledge without responsibility".

Many of those who write about the present tasks of science in society do so without displaying much hope that the problems will be solved. Bernal belongs to the opposite school:

It is now evident that enough is known, both of natural science and of techniques making use of it, to solve all the problems of world economy. We should now be able to provide a tolerable standard of life for the peoples of the whole world, and by further research it could be improved indefinitely.

*Science in History* provides both encouragement and guidance for those who wish to prove the truth of this claim.

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